MEMORANDUM FOR THE CHIEF OF NAVAL RESEARCH

Subj: SCIENCE AND TECHNOLOGY CORPORATE BOARD DECISION MEMORANDUM

1. The Corporate Board endorses and approves the Naval Science and Technology Strategy presented at the 12 December 2006 Science and Technology Corporate Board meeting and directs the Chief of Naval Research to implement the strategy.

R. Magnus
General, U. S. Marine Corps
Assistant Commandant of the Marine Corps

R. F. Willard
Admiral, U. S. Navy
Vice Chief of Naval Operations

Dr. Delores M. Etter
Assistant Secretary of the Navy Research, Development and Acquisition
DoN S&T Strategy Objectives

• Ensure alignment of Naval S&T with Naval missions and future capability needs
• Communicate S&T vision and approach to senior decision makers, key stakeholders, S&T partners, customers and performers
• Balance and manage S&T portfolio based on key tenets:
  – Strive to touch intellectual capital worldwide
  – Leverage U.S. and global technology insights
  – Sponsor primarily external performers
  – Maintain NRL in-house research capability as the Navy/Marine Corps Corporate Laboratory
  – Manage a balanced portfolio with technical Program Officers
# Naval Warfighting and Support Functions

<table>
<thead>
<tr>
<th>Naval S&amp;T Focus Area</th>
<th>Naval Warfighting and Support Functions</th>
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<tbody>
<tr>
<td><strong>Power &amp; Energy</strong></td>
<td>- Power Generation and Storage • Assured energy sources • Man Portable &amp; Lightweight • High-Density Power</td>
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<tr>
<td><strong>Operational Environments</strong></td>
<td>- Oceanography &amp; Survey (Ocean/Hydro/River) • Meteorology • Space Environmental Effects</td>
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<td><strong>Maritime Domain Awareness</strong></td>
<td>- ISR collection &amp; integration • CBRNE (Explosives &amp; WMD Detection) • Port/Base Security • Swimmer Detection • Wide Area &amp; Battlespace Surveillance • Social/Cultural Understanding • MIO Sensing • HLS Ship Tracking</td>
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<tr>
<td><strong>Asymmetric &amp; Irregular Warfare</strong></td>
<td>- Operational Adaptation • Maritime/Riverine Interception Operations • Expeditionary Security • Boat/Vehicle Disabling (Apply Non-Lethal Systems &amp; Effects) • Forensic Site Exploration • Tactical Evidence Collection • Counter IED/Snipers • Riverine Operations • Regional Domain Awareness • Homogeneous Cultural Integration of Forces • Tactical Tagging and Tracking</td>
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<tr>
<td><strong>Information, Analysis and Communication</strong></td>
<td>- Assured and Secure Communications • Electronic Warfare • Computer Network Ops • Operations Security • Military Deception • Cross Cultural Communications • Threat Intent Determination • C4</td>
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<td><strong>Power Projection</strong></td>
<td>- Rapid Tactical Precision Targeting • Time-sensitive strike • Neutralization (lethal/non-lethal) • Effects-scaled weapons • Integration &amp; Control of Naval fires • Maneuver</td>
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<td><strong>Assure Access and Hold at Risk</strong></td>
<td>- Persistent Surveillance &amp; Monitoring • Tagging/Tracking &amp; Locating • Shaping and Information Operations • Strategic Target ID/Tracking • Information Verification • Vessel/vehicle-stopping • MIO/Boarding • ASW &amp; MCM • Spoof/Decoy</td>
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<tr>
<td><strong>Distributed Operations</strong></td>
<td>- Distributed Logistics • Small Unit ISR/Intel Collection/Dissemination/Fusion &amp; Engagement • Tactical Maneuver &amp; Mobility • Control of Integrated Fires • Training Operations in Urban/Extreme Environments • Large target lethality with reduced combat loads • Control Collateral Damage</td>
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<td><strong>Naval Warrior Performance and Protection</strong></td>
<td>- Personal Protection • Endurance • Decision-Making Tools • Decision/Training Tools • Casualty Prevention/Care • Undersea Medicine • Enhanced Human Performance • Operating in Extreme/Austere Environments • Expeditionary Security • Training Operations in Urban Environments</td>
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<tr>
<td><strong>Survivability and Self-Defense</strong></td>
<td>- Missile Defense • Torpedo Defense • LO/CLO • Tactical EW • Damage Control/Prevention • Force Protection • Time-Critical Terminal Defense</td>
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<td><strong>Platform Mobility</strong></td>
<td>- Platform Performance &amp; Agility • Power-Dense Propulsion • Operational Adaptation • Tactical Maneuver Mobility</td>
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<td><strong>Fleet/Force Sustainment</strong></td>
<td>- Seabasing • Operational Logistics • Maneuver</td>
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<td><strong>Affordability, Maintainability, and Reliability</strong></td>
<td>- Increased warfighting capacity • Reduced logistics cost optimization • Reduced failure rates • Automate Naval engineering • Aircraft Propulsion Design • Reduce Manning • M&amp;S Automation • Reduce Upgrade Costs</td>
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Results of S&T Strategy

Navy and Marine Corps will have:

- Domination of the Electro-Magnetic spectrum and cyber space
- Implemented Directed Energy – Fighting at the Speed of Light
- Achieved persistent, distributed surveillance in all domains
- Achieved comprehensive MDA with large vessel stopping and WMD detection for EMIO
- Incorporated affordability into platform design and construction
- Adaptive, wireless communications networks
- Decision tools for Commanders that provide tactical advantage
- Determination of threat intent thru social / cultural understanding
- Lighter, faster, more lethal Marine forces
- Accelerated team training & skill development
- Increased operational effectiveness thru more efficient power/fuels
- Responsive / visible logistics to enable distributed forces
- Greater tactical advantage through superior knowledge / use of operational environments
DoN S&T Portfolio Balance

Discovery & Invention (Basic and Applied Science)

Leap Ahead Innovations

Acquisition Enablers

Quick Reaction S&T

S&T has a long-term focus but is responsive to near-term Naval needs
## Types of ONR programs

<table>
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<tr>
<th>% of Portfolio</th>
<th>Discovery and Invention</th>
<th>Future Naval Capability</th>
<th>Direct Fleet Support / Quick Reaction</th>
<th>Innovative Naval Prototype</th>
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<td>40</td>
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<td>30</td>
<td>10</td>
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### Focus
- Expanding frontiers of knowledge in areas of naval interest
- Transitioning mature S&T to acquisition program of record
- Solving emergent fleet / force needs
- Demonstrating Leap-ahead technology

### Motivation
- Broad Naval needs and opportunities
- OPNAV-identified capability gap
- Fleet-identified need
- Significant military advantage

### Example
- Ocean Acoustics
- Improved water jet propulsion for JHSV
- IED Jammer
- Electromagnetic Railgun

### Type of Innovation
- Disruptive or sustaining.
- Sustaining - makes an existing capability better
- Disruptive or sustaining.
- Disruptive - makes an existing capability obsolete

### Time frame
- Continuing
- 3-5 years
- 1-2 years
- 4-8 years

### Typical TRL entry point
- TRL-0 to TRL-2
- TRL-3
- TRL-4 to TRL-5
- TRL-2 to TRL-3

### Typical TRL end point
- TRL-3 to TRL-4
- TRL-6
- TRL-7
- TRL-6

### Technical Difficulty
- High
- Medium
- Medium
- High

### Operational Integration Complexity
- N/A
- Usually straightforward
- Medium
- High

### Approval Level to start a program
- ONR Department
- Technology Oversight Group (3-Star)
- ONR Corporate
- DON Corporate Board (4-Star)
Power Projection

Vision: Precise extended range indirect fires, time-critical power on target and control of collateral damage through electromagnetic kinetic projectiles, hypersonic missile propulsion and scalable effects weapons.

Objectives

Future Navy Fires
- Increased fires volume & accuracy
- GPS denial compensation
- Indirect fires to 250 miles from safe offshore locations

Control Collateral Damage
- Scalable effects weapons
- Selectable/directional lethality

Time Critical Strike
- Hardened target/moving target reach & destroy
- Worldwide to meet warfighter requirements

Small Unit Combat Power
- Increased small unit weapon lethality
- Neutralize larger hostile forces

Combat Insensitive Munitions:
- Reduce system sensitivity to sympathetic detonation
- Maintain payload range & lethality

Key Research Topics

Advanced Energetics
Directed Energy
Electromagnetic Guns
High Speed Weapons Technologies
Precision Strike
Undersea Weaponry
ASW Rapid Attack
Mining
Non-Lethal Weapons
Signature Control & Sensors (LO/CLO)
EW Attack
Expeditionary Firepower
Power Projection Needs

### Naval Sea Systems Command & Affiliated PEOs
- Science and Technology Needs 19 December 2006
- Surface Community POM08 Investment Guidance

### Marine Corps
Science and Technology Strategic Plan August 2007

### Naval Aviation Enterprise
Science and Technology Strategic Plan
Commander Naval Air Forces
Commanders Naval Air Systems Command
Director, Air Warfare
01 July 2006

### NETWARCOM
- Top 10 Fleet Requirements Sep 2006
- PEO C4I Science and Technology Alignment and Transition CONOPS 29 Sep 2006

### Undersea Enterprise (USE)
SCIENCE AND TECHNOLOGY (S&T) PRIORITY TECHNICAL CHALLENGE AREAS OF INTEREST 07 APR 2006

### Navy Expeditionary Combat Command
Science and Technology Objectives (STOs) DRAFT as of 05 June 2007
- N8F FNC Gaps (PR 09, POM 10)
- Communication with N8F, N81, N85, N86, N87, N88 Science Advisors
Control Collateral Damage

HEL for Tactical Air Applications

Enhanced Lethality & Range Munition

Selective/Directional Lethality

Future Assault Weapon Munition

Scalable Effects Weapons

MEMS Fuze

Modular Scalable Effects Weapon

Advanced Energetic Materials

Next Generation Airborne Electronic Attack (AEA) Enabling Capability

EM Railgun

Future Mortar Munition

Enhanced Blast/Scalable Effects Bomb

Approved for Public Release: Distribution Unlimited
Time Critical Strike

- RATTLRS
- Combustion Light Gas Gun
- Enhanced Weapons Technologies
- Advanced Propulsion Concepts (Pulse Detonation Engine shown)
- Low Cost Imaging Terminal Seeker
- Free Electron Laser
- Weapon Data Link
- Direct Attack Seeker Head
- Multi-Mode Sensor Seeker
- M-VVID
- EM Railgun
- HEL for Tactical Air Applications
- Worldwide to meet Warfighter Requirements
- Hardened Target/Moving Target Reach & Destroy

Approved for Public Release: Distribution Unlimited
Small Unit Combat Power

- Modular Scalable Effects Weapons
- Neutralize Larger Hostile Forces
- Enhanced Lethality & Range Munition
- Increased Small Unit Weapon Lethality
- Future Mortar Munition
- Future Assault Weapon Munition
- DO Precision Engagement
- Advanced Energetics Materials
- MEMS Fuze
- Energetics D&I
- Assault Weapon Propulsion
- Tactical Urban Breaching Munition
Combat Insensitive Munitions

Emerging Energetic Materials

M = transition metal, main group metal targets include Ti(IV), Al(III), Fe(III)

Maintain Payload Range and Lethality

Reduce System Sensitivity to Sympathetic Detonations

Free Electron Laser

EM Railgun

HEL for Tactical Air Applications

Enhanced Blast/Scalable Effects Bomb

Advanced Energetics Materials

Shock Sensitivity Dependence of RDX on Particle Size

IHE- 77% 1-RDX Eurenco Sieved

IHE- 77% Eurenco RDX

50%-Point Sensitivity, kbars

Bin Mean-Particle Diameter, microns

CSIM Sensitivity

Approved for Public Release: Distribution Unlimited
Naval Precision Strike Futures

Future Options

Today’s Cruise Missiles

Tomahawk

Harpoon

1.0  3.0  5.0  7.0  Speed of Light

MACH